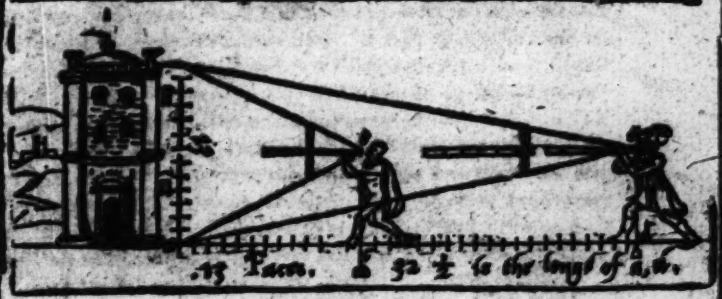
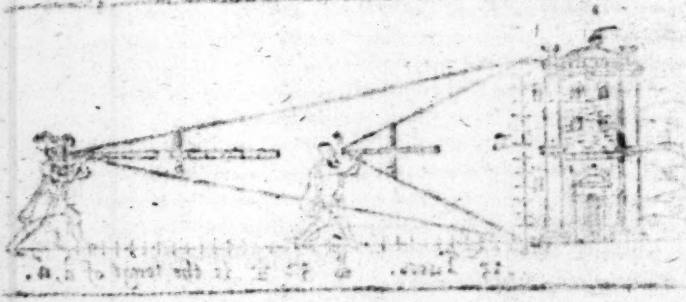
A BOOKE NAMED TECTONICON.

briefly shewing the exact measuring, and speedie reckoning all manner of Land, Squares, Timber, Stone, Steeples, Pillers, Globes, &c. Further, declaring the perfect making and large use of the Carpenters Ruler, containing a Quadrant Geometricall: comprehending also the vse of the Squire. And in the end a little Treatise adjoyning, opening the composition and apply'nacy of an Instrument called the Profitable staffe. With other things pleasant and necessary, most conducible for Surveyors, Land-masters, Joyners, Carpenters, and Masons.

Published by LEONARD DIGGES *Gentleman, in the yeare of our Lord*, 1556.



LONDON,
Imprinted by *Felix Kingston*.
1647.



L.D. To the Reader.

Although (gentle reader) many excellent in Geometry, upon infallible grounds, have put forth divers most certaine and sufficient rules, touching the measuring of all manner Superficies: yet in that the Art of numbring hath been required, yet chiefly thereunto tied, and as it were locked up in strange tongues, they do profit (or have furthered) very little the most part: Carpenters, Joyners, Masons, wanting the aforesaid. For their sakes I am here provoked not to hide but to open, and so encrease the Talent which I have received: yea to publish in this our Tongue very shortly (if God give life) a volume containing the flowers of the Sciences Mathematicall, largely applyed to our outward practise, profitably pleasant to all manner of men in this Realme. In the mean time I shall desire the Artificers above named, to be contented with this little Booke (a taste of my good will towards them) which I wish even so to further the Readers, as I know it sufficient for the true measuring and ready accompt of all manner Land, Timber, Stone, Board, Glasse, Pavement, &c.

Here mine advice shall be to those Artificers that will profit in this, or any of my Bookes now published or that hereafter shall be, first carefully to read them through, then with more judgement. Reade at the third reading, wisely to practise: Seven things shall you make sure. Note, that diligent reading, joyned with ingenuous practise, passeth profitable labour.

Thus most heartily farewell (loving Reader) to whom I wish my self prosper, to further my desire and profit to those.

THE PLEASANT PROFIT OR Content of this little Booke, and in what it *exceedeth all other published,*

OTher Bookes before put forth in our English tongue, contained only the bare measuring of Land, Timber, and Boord: how agreeable in all places to the rules of Geometrie, let the learned iudge. Here (gentle Reader) thou shalt plainly perceive through diligent reading, how to measure truly, and very speedily all manner of Land, Timber, Stone, Steeples, Pillers, Globes, Boord, Glasse, Pauements, &c. without any troublesome paines with many rules, or obscure termes, nor yet with the multitude of Tables, as heretofore hath bin: in which not a few errours were committed: for that cause no iust account might any way bee had. Further yee shall by this booke understand the whole making and comely handling of the Carpenters Ruler, with the true measure, &c. And his use appointed to the ready measuring of all kind of Timber, Stone, Boord, &c. Also the levelling of grounds, and taking of heights, is pleasantly and diuersly practised by the Ruler. Yee have here not the common, but the rare use of the Square, applied to heights, lengths, &c. And to the finding of the iust houre of the day diuers waies, through the aide of pleasant Tables newly adioyned to my generall Prognostication: by the which the proportion of things, direct or squarewise standing, are by their shadowes knowne.

To conclude, in the end of this Booke is added a Treatise, shewing the making, and use of an Instrument, by which yee shall get lengths, heights, breadths, wideneſſes, where or howsoeuer they stand. Other necessary things are contained in this little volume, which I commit to the diligens

BIBLIOTHECA COLL: SS: TRIN: DUBLIN:

DIVERS

DIVERS THINGS CONDVCIBLE TO THE ART OF MEASVRING.

The first Chapter.

AS there are few Craftsmen which haue all the kinds of Arithmetike readily ; so I doe suppose mine to be vnknowne, but that they doe yet may easily perceiue the simple significations of theire Characters or figures, 1. 2. 3. 4. 5. 6. 7. 8. 9. 10. And alsa theire strength in the first, second, and third roomes places. Characters numerall.

Besides that, they must be familiar with these and such like Fractions.

1/2. 1/3. 2/3. 1/4. 3/4. 1/5. 2/5. 3/5. 4/5. 1/6. 5/6. 1/7. 1/8. 3/8. 5/8. 7/8. 1/9. 1/10. The first letters betokeneth one seuen part of an whole, be it Pearch, Inch, or any other measure : the nexteone three, then one seuenth parteth either vnto sixteen, one sixteenth. So one thirty and two parts of an Inch. Then follow three fourths : foure fifths. The last is nine tenths of an Inch : that is, nine parts of an Inch, diuided into tenne portions. Fractions.

Whilst I doe intend to put in my Examples, and in my Tables and margins following, to represent parts of Pearches or Inches. As if I would write halfe an Inch, after

this manner ½. Three quarters of an inch thus ¾. One eight of a Pearch, on this wise ⅛. So of the reſt.

It is requiſite alſo here to open what a Pearch, a Daywerke, a Rode, and an Acre is.

Although there be diuers opinions engendred through long cuſtome in many places of the length of a Pearch (vpon which our chiefe matter dependeth) yet there is but one true Pearch by ſtatute appointed to meaſure by. Wherein is obſerued three Barly cornes drie and round to make an Inch: twelue inches, a Foote: three Foote, a Yarde: fiue Yardes, ½. a Pearch: fortie Pearches in length and foure in breadth, an Acre. So an Acre by Statute ought to containe 160. Pearches: the halfe Acre 80. Pearches: a Rode, commonly called a quarter, 40. Pearches, a Day worke 4. Pearches. Let learne the Acre expreſſed both his length and breadth.

Acre		
1	160	
2	80	
4	40	Length.
8	20	
16	10	
Breadth		

Inſtruments to meaſure with Poales. Cord knotted. Profitable ſtaffe:

I muſt not omit here to tell you what thing is meeteſt to meaſure Lands with. They are commonly in the countrey two Poales, either of them the length of a Pearch. They are very good: yet for all kinde of Lands, a Cord two Pearches in length, well graded with many euen knots, knotted or marked at the end of euery Pearch, is more ſheere and readier. But in my fantaſie, the inſtrument Geometricall, which is put forth in the end of this Booke, paſſeth them all and other, for the exact truth and quickeſt ſpeede: this Inſtrument is ſo generall and aduiſeable in ſo diuers things, that it alone requireth a large Booke, if it ſhould be ſufficiently ſet forth.

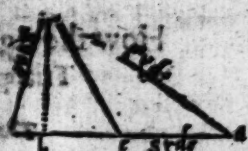
Triangle.

This I would we haue you ignorant what piece of Land is called a Triangle, which often hereafter ſhall be named. It is ſuch a faſhioned piece as hath (as is imagined to haue) three ſides, and three Angles onely: whether the ſides be equall or otherwiſe, as this figure ſheweth. Againe, when a line is ſaid to fall Squirewiſe when it entereth any thing at any of a Triangle full croſſe, like vnto a Squire. As the hanging

Line falling Squirewiſe.

pitcher

pricked line a. b. in c. d. the base line of the Triangle. Lee it cutteth the five Squirewise, or full crosse in the point b. and not so the other line a. c doth. The base of any triangle is here called that five, which is cut Squirewise of the hanging line.



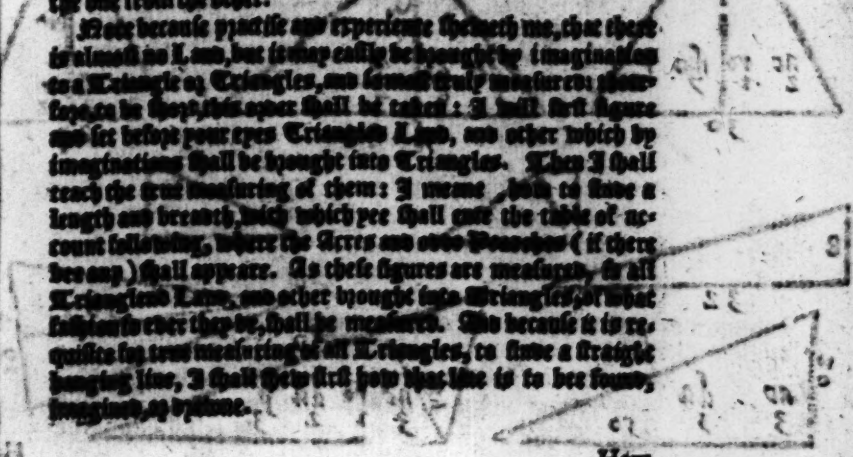
Base line.

Concerning a Circle, I finde, that the compasse of any Circle is called a Circumference: the middle point as here, f. Circle. Circumference. Center.

Connecte the right line b. i. that goeth directly thorow that Center passing the Circumference on both sides in his Diameter: the halfe of that line, the Semidiameter. Also an Arch is a peece of the Circumference cut away: as ye see the Arch above the line f. g. Also f. g. b. i. in this Circle are named parallels: for that they differ equally in all places, the one from the other.

Diameter. Semidiameter. Arch. Parallels.

Note because practise and experience sheweth me, that there is almost no Land, but it may easily be brought by imagination to a Triangle or Triangles, and formally truly measured thereafter, to be sayd, this ensuer shall be taken: I will first figure and set before your eyes Triangled Land, and other which by imaginations shall be brought into Triangles. Then I shall teach the true measuring of them: I meane, how to finde a length and breadth, with which ye shall enter the table of account following, where the Acres and odde Poushes (if there be any) shall appeare. As these figures are measured, so all Triangled Land, and other brought into Triangles, of what fashion so ever they be, shall be measured. Also because it is requisite for true measuring of all Triangles, to finde a straight hanging line, I shall shew first how that line is to bee found, progressing as ensueth.



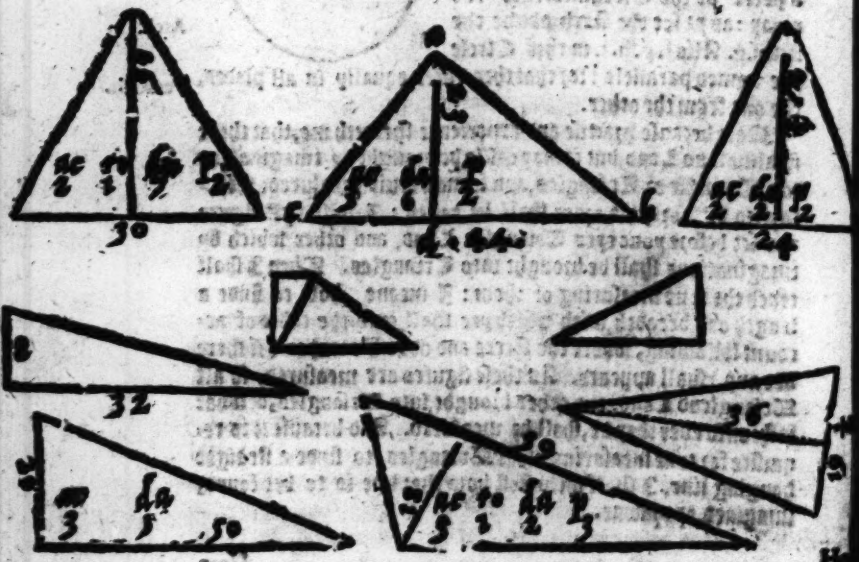
How

How the right hanging line in Triangles is drawne.

The ij. Chapter.

To draw a hanging or plumbe line.

THis straight hanging line in all Triangles is ever drawn as imagined from any Angle passing some one side of that Triangle perpendicular: per may perceive the perfect lines in the Triangles following. By the helpe of this line, all Lines of Triangle bodies, are brought to ther measures as exactly.



How to meaſure all manner Triangled Land.

The III. Chapter.

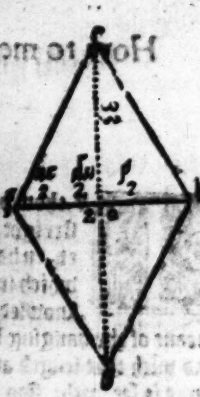
If thou per-ceiue by Geometricall multiplie this ſtreight hanging line, drawne, as aboue is there, in halfe the number of Pearches of that ſide, which it cutteth Squarewiſe. For more of the knowledge, take the aforenamed Pearches (I meane of the hanging line, and halfe the ſide which he cutteth) and with that length and breadth enter your table of account, as there is ſet forth: So ſhall yee perceiue the number of Acres, Roods, Day-workes, &c. Euclid. the 1. Booke 41. pro.

Example.

For the perfect meaſuring of Triangles aboue figured, and all other, ſuppoſe the ſecond of theſe laſt nine figures of the other ſide, hauing written aboue it, a.b.c. to bee a peece of land, whereof I would haue the true meaſure, I finde by a Cord, as before ſaid, the pricked hanging line a. b. to bee 23. Pearches; the ſide b. c. which it cutteth ſquarewiſe 44. Pearches, whoſe halfe is 22. With theſe 2. and 23. the conuenient length and breadth, I enter the table of account. There I finde by that table at the corner where both the lines of conuenient length and breadth do meete 3. Acres, 6. day-workes, and two Pearches to be in that Triangle. Thus of all before figured.

Here note your table muſt euer bee entred with all the Pearches of the hanging line, and with halfe the ſide that hee cutteth Squarewiſe. Or with the halfe hanging line, and the whole ſide. This Table followeth.

A figure of a double Triangle.



This figure e.f.g.h. is but two Triangles: and therefore measured as above in two partes. Do thus: The hanging line e.g. is 33. Pearches; the line f.h. that beareth square vnto it 20. Pearches, the halfe of the which is 10. Now enter your table as before with 33. and 10. the conuenient length and breadth. So shall yee finde two Acres, two Daywerkes, and two Pearches, the true content of this figure e.f.g.h.

Figures of many Angles.

Another Example.

Admit i.k.l.m. land to be measured. Because it is no maner triangle, it must be brought by imagination, as I haue saide, into a triangle or triangles. Which imagination is heare signified by the line dashed i.l. Then as above is declared, it ought to bee measured (according to the rule of triangles) in two partes, because there are two triangles in that Land. So by proofe yee shall finde in the vpper i.m.l. one Acre, 3. Roods, and five Daywerkes: in the other i.k.l. one Acre. Thus I gather the whole content of that Land, to bee two Acres, three Roodes, and five Daywerkes.

None

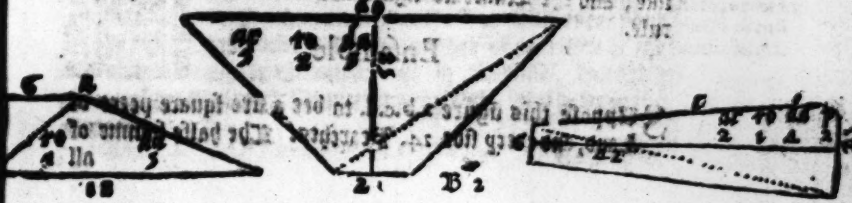
Mone otherwise of the abiogmus, n.o.p.q. and all other figures following: and other whatsoeuer they are, that by any meanes may be brought into triangles.

Furthermore know that the figure i.k.l.m. is readilie thus measured. Adde the pearches of both the hanging lines together, whiche yee 23. Multiplie this number, and with halfe the Pearches of the base, i.l. which be counted squarewise, being 10. Pearches, enter your table. So is found as afore.

These two figures following may also bee thus measured, otherwise then by the rule of Triangles. Enter your Table with their conteined length and breadth. So shall you finde the contents shall such.

These three figures following, although they may bee measured by the rule of Triangles, yet for quicker speed, they have also their proper measuring as ensueth.

Lay together the two sides which are parallels of the first figure, that is 6 & 18. making 24. the halfe is 12. the breadth 5. Enter with 5. and 12. your table. So shall you finde 60. 5 my waches. For the other two bee euen like, adde the heads together euen in one: and enter your table with halfe of those Pearches, and with the whole number of the middle line.



How by supputation to measure all Triangled Land.

To measure triangled land by supputation

JOyne all the sides together, take halfe out of that halfe, pull every side, noting the differences. Then multiply the differences, the one in the other, and the third difference augment in the product. That which encreaseth, multiply in the halfe of all the sides ioyned. Then the Roote of the surmounting summe, is the content of that triangle.

Foure rules following.

Now rest foure Rules to be treated of. The first for all manner Regular square Superficies. The second for round Land, and her parts. The third for Steeples, Columnes, Globes, and their parts. The last for Mountaines, and Galleyes. Here they shall in order follow.

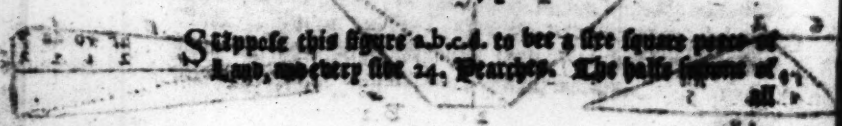
A rule for all manner regular or right squared Land of many sides, as 5.6.7.8.9.10.20.100. &c.

The iiii. Chapter.

To measure land of many sides.

MEasure and lay all the sides together, taking the halfe number of Pearches there contained. Then draw a right hanging line from the Center or middest of that figure, to the middest of some one side. And with that length and the other, enter your table. Note that the triangle of all sides like, and the Quadrate figure are also measured by this rule.

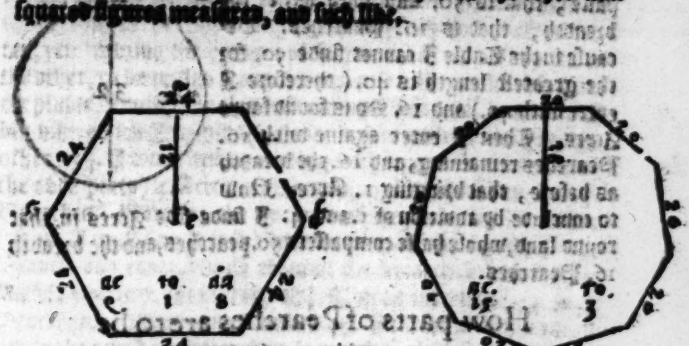
Example.



SUppose this figure a.b.c.d. to bee a five square peece of Land, and every side 24. Pearches. The halfe summe of all

all ſides is 72. Pearches: the right hanging pricked line 2. c. 21. Pearches. With theſe two numbers yee muſt enter your table of account following hereafter. And doe as is ſpoken in the declaration there aforeſaid, when Numbers ſurmount the table as they be here.

So ſhall ye finde 9. Acres, 1. Rood, and 8. Pearches, the Content of this figure a.b.c.d. Even thus is the other nine ſquared figures meaſured, and ſuch like.



A Rule for round Land, and the parts thereof.

The v. Chapter.

TAke the Diameter multiplied in ſome the Circumference, ſheweth the Content of any circle.

Or thus more plainly. Yee ſhall enter your table with halfe the number of pearches of the whole Circumference or compaſſe, and with the number of halfe the Diameter aforeſaid. So ſhall ye the Content. Archimedes in libello circuli menſurationis.

Example.

Example.

Suppose a peece of Land, wherein the compasse is 100. Pearches, the breadth 32. Pearches. I would know how much Land is in this figure. Enter your table with halfe the compasse, that is 50. and with halfe the breadth, that is 16. Pearches. Because in the Table I cannot finde 50. for the greatest length is 40. (therefore I enter with 40.) and 16. so is found foure Acres. Then I enter againe with 16. Pearches remaining, and 16. the breadth as before, that bringing 1. Acre. Now to conclude by addition of 1. and 4. I finde five Acres in that round land, whose halfe compasse is 50. pearches, and the breadth 16. Pearches.

How parts of Pearches are to be counted in measuring.

For perfect knowledge and use of this Table following, when parts of Pearches are adjoyned, note well this other example that ensueth, and also what is said of the declaration annexed unto the Table, when parts of Pearches are in the length, breadth, or both.

Imagine e. g. h. to be a round peece of Land; I finde by measure the whole Compasse 99. Pearches. The halfe is 49. ½. The hanging Line or halfe breadth is 15. ½. Enter your Table with the whole Pearches, that is 49. and 15. leaving out ½. and ¼. which were but parts of Pearches. So have

see

yee 4. Acres, 0. Roodes, 3. Day-worques, and three Pearches. For thole partes of Pearches omitted, at your first entring the table, worke thus. The halfe Pearch, Quarter, or other part of a Pearch in the length, must bee reckned by their fellowes in the whole breadth, and thole of the breadth contrary-wise in the length. If there be such odde partes in both, then reckon them of the length in the whole breadth, and them of the breadth in the whole length, ioyning to the other aforegotten, remembring the manner of the one fraction multiplied in the other, to be pulled from the encrease. To make this matter plaine, I will take this last example before. The one number wherewith I should have entred my table, was 49½ the other 15¼. I found first by entring with 49 and 15. (omitting the odde parts) 4. Acres 2. Roodes, 3. Day-worques, and 3. Pearches. Now for the encrease of the partes of Pearches left out I must (as I said) reckon them of the length in the breadth, and contrariwise them of the breadth in the length. Halfe 15. ¼. is 7. Pearches, and ¼. Those quarters of 49. is 37 Pearches, ½. Which added makes 45. Pearches. This annexed to the number aforegotten, bringeth to the whole content of the round figure, which is 4. Acres, 3. Roodes, 4. day works, 3. Pearches, and ½. of a Pearch, the product of the one fraction multiplied in the other supposed. What must be done when the numbers wherewith yee should enter, exceed your table, counsell the declaration of your table therein ahoughte.

Of the halfe Circle.

For this halfe circle, enter the table with halfe the compasse, and with halfe the Diameter of the Circle, or with the length of the picked hanging Line, k. l. So the content of this halfe circle is 2. Acres, 1. Roode, 7. Day-worques, 1. Pearch, and $\frac{11}{12}$. of a Pearch.

To measure halfe circled Land.

Another

Another example of Portions and parts of a Circle.

Suppose n.m.o. following, were part of a Circle or peece of Land, whose Content ye desires. The whole compasse of the Circle which this portion representeth, is (as aboue saide) 92. Pearches: his Diameter or breadth 31.½. The pricked Rule of Compasse r.m.o. is 74. Now with the halfe Breadth or Semidiameter of the Circle, 15.¼. and with 37. the halfe of the pricked Compasse, enter your table. So haue ye 3. Acres, 2 Roodes, 5. Day-woorkes, 2. Pearches, and ¼. of a Pearch, the Contents of the peece of Land full of pricks, to the lines of the Triangle pricked.

To measure parts of circled Land.

If ye desire to know the sum of pearches in the other portion beneath the Triangle, separated by the line, m.o. ye must adde the Content of the Triangle (which is three Roodes and ½. of a Pearch, found by the Rule of Triangles) to the Acres and Pearches before searched. So haue ye 4. Acres, 1. Roode, 5. Day-woorkes, three Pearches, and ½. of a Pearch.

This substracted or pulled from the number contained in the whole Circle, the remaine is the Pearches included in the small peece beneath the Triangle. That is, 1. Roode, 36. Pearches, and ½. of a pearch.

How mixed Figures are measured.

Land compounded of circles or his parts.

I thinke none now will doubt how these two figures following are measured, because they are made of portions or parts of Circles, whose measure is before sufficiently ope-

ned

ven, the one consisting of two halfe circles, and a Quadrangle: the other being the portion of the circle, as o. doubled.

If any shall fall into my Land chance to be measured, which [illegible] Triangles, to save labour, [illegible] and make it Square, it [illegible] them be measured: and after, from the [illegible] pull away that per addes: the remaine is the Content.

To finde the Content superficiall of Steeples, Columnes, Globes, and their parts.

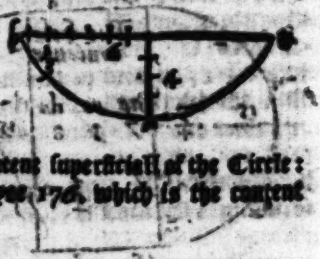
To measure Steeples, Columnes, Globes, &c.

TO the Arithmetician, I say: to picked Steeples multiply the whole line to halfe the circumference of the Base, [illegible] plaine of the Base. For pillers [illegible] the Circumference of the one in the [illegible] portion of the plaine of [illegible] the Diameter to the Circumference [illegible] parts. Let them [illegible] Arithmetike enter my table of account: [illegible] as I have written the Instrument [illegible] expressing what I have before written. So I forget their name.

Or thus by the rule of proportion, the parts of a Globe are found.

To measure pars of Globes.

Suppose a. b. c. to bee a peece of a Globe, and 4. to bee a proportion of the Diameter, the whole being 14. Thus I say, 14. the whole Diameter giveth 616. the Content superficiall of the Cirrle: what shall 4. bring: So have you 176. which is the content of that peece.



To finde the Diameter by some knowne portion thereof.

To finde the unknowne Diameter of a Globe.

If ye be ignorant what length the Diameter of the Globe (or whole proportion) be, the better to finde the Diameter being 4. foote, augment unto the like 3. times 4. by himselfe, and the product bring to 4. and have you 196. to be added to 4. which maketh 14. the whole Diameter.

The true measuring of Mountaines and Valleyes.

To measure Mountaines.

the halfe part of the Altitude copied, and then shall yee see the Content.

Example.

Enſample.

A.b.c. is the mountaine: a.c. the circuit of the baſe, being 100. Pearches, b. the top 16. Pearches. Which ſubſtracted together, make 116. b.c.

Figure of a Mountaine.

the one circuit is 55. Pearches: the other 75. Theſe numbers make 130. The halfe of the circuites is 58. the halfe of the diffe-

ſum of which theſe numbers

ſumme you ſhall euer

ſame table of account, where ye ſhall finde 42. Pearches, and 30. Pearches, the true contents of this figure gili.

Of the Valley.

As in the Mountaine ye meaſured the circuit or compaſſe of the top of the ſame in Feete: ſo here contrary wiſe ye ſhall meaſure the circuite or compaſſe of the bright of the Valley. And as ye got the meaſure or compaſſe of the top of the Mountaine, ſo meaſure the circuite of the depth of the Valley. In this manner as ye meaſured the Aſcenſe, that is the going up from the foote to the top: ſo meaſure the Deſcenſe or going downe of the Hill to the depth of the Valley. The reſt all worke, as I have ſhewed you in meaſuring the Mountaine. For more plaine-

neſſe, behold this

enſample, as

ſhall. If you ſay

together the

cuites of the

height, ſubſtract

which is 30. then ſhall there remaine 30. and 30. taking the halfe part of thoſe two Circuites, making

To meaſure Valleyes.

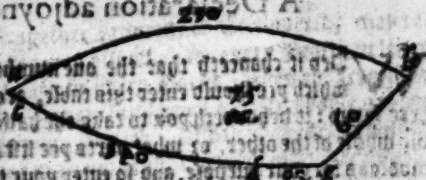


Figure of a Valley.

an 120. then the two Accides 140. and 60. added in one product 200. the halfe thereof being 100. with this and 120. the other halfe of the Circuite, ye may enter your table. That being, for 75. Acres.

How the Table of account now following is to be used.

What is to bee done when numbers, with which you should enter, exceede your Table.

When you haue gotten a conuenient length and breadth (as I haue also before declared by diuers triangles and other figures) then you shall enter this table. Seeke there the Length, and most number of Perches in the higher hanging, which beginneth at 1. and goeth right-ward as you see: then seeke the summe of Perches (I meane the breadth) in the right line and hanging margine, from 1. vpward to 30. Now at the meeting of the line, where the one answereth the other directly in a square, you shall finde the Acres, Roodes, Day-workes, and Perches. Note that the first number (or on the left hand) in the upper part in the square, signifieth the number of Acres. The figure 1. set in the upper part, and right line, doth betoken 1 Roode: the figure 2. three two Roodes. 3. three Roodes. And the figure in the left side beneath, signifieth 1 Day-worke, or Day-workes. The figure in the lower part right-ward, declareth Perches.

A Declaration adjoyned.

When it chanceth that the one number of both sides which ye should enter this table, are greater then any here stand: it behoueth you to take the halfe of the one, and the whole of the other, or what parts ye list of both, most commodious for your purpose, and so enter your table. Looke then what is there found, and it shall beare his name of the parts multiplied in themselues.

Example.

Enſample.

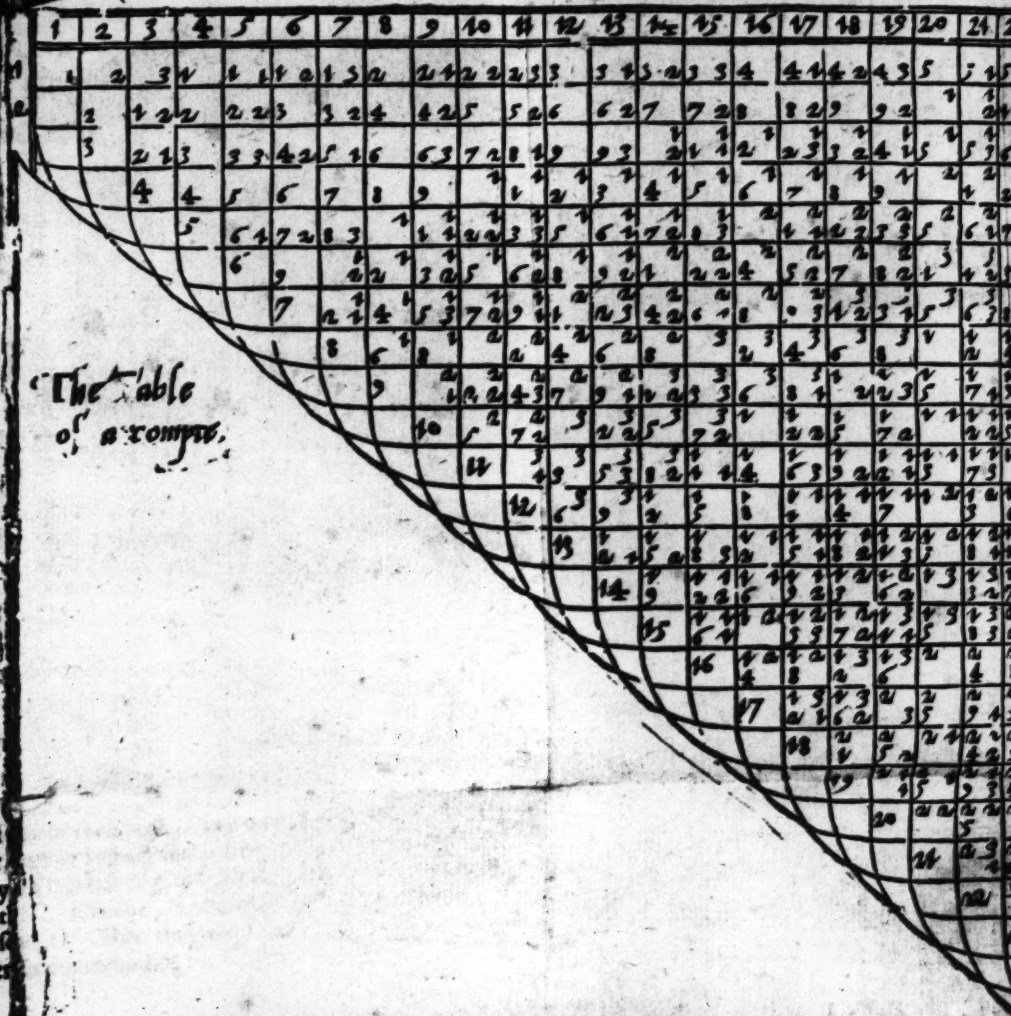
Suppoſe the number with the which pee ſhould enter your table to bee 130. Pearches in length, and the breadth 60. neither of theſe may be found in the Margine: wherefore I take the third part of 130. which is 34. Pearches, and one remaineth.

The halfe 60. that is 30. I finde with entring them at the common meeting. 6. Acres, 1. Roode, and 5. Dayworkes. This ſumme muſt have his name of the parties augmented in themſelves. I tooke the third part of the one, and halfe the other number, therefore 2. muſt be multiplied in 3. by contrarie: ſo have pee fixe, which ſignifieth that pee have found by entring but the ſixth part of the number pe ſhould finde. Wherefore I muſt take this ſumme before found (being 6. Acres, 1. Roode, and 5. Day-workes) ſixe times as much. So have pe 33. Acres, and one Roode. For the Pearch remaining in length, reckon him in the breadth (as is afore declared) in the fifth Chapter of the Remaines: ſo have pe 60. Pearches more to bee added. So the encreaſe of theſe two numbers 103. and 60. amount to 38. Acres, two Roodes, and five Dayworkes. Thus any manner length and breadth is reduced to this table following, which ſufficeth.

Looke what I have ſhewed in the Chapter of parts, that underſtand here of whole Pearches, left ſubſtracting, &c.

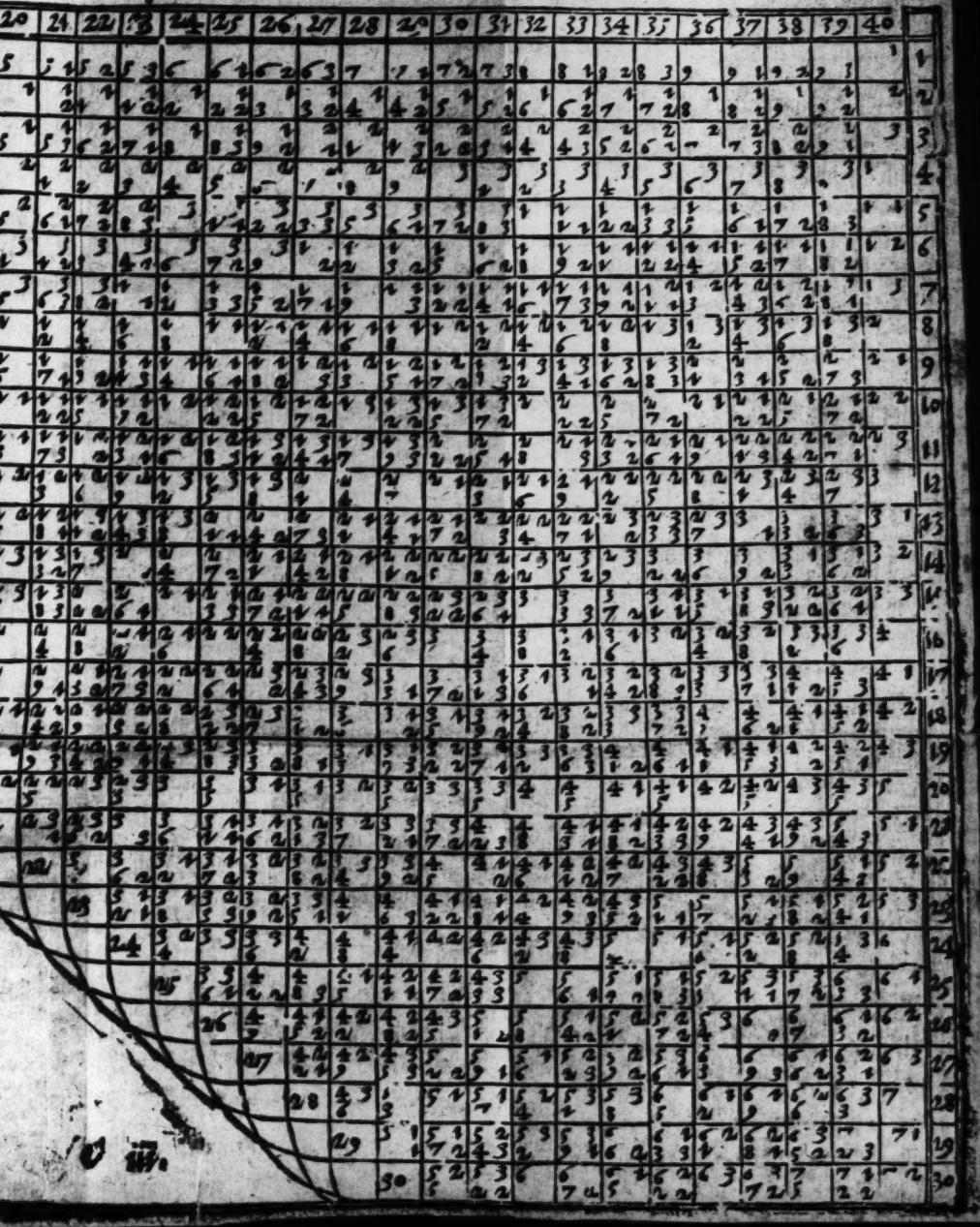
Thus with few words is ended the certaine meaſuring of all manner Land, touching the Superficiall Content. Wherefore now ſhall follow the true meaſuring of Timber, Stone, Steeples, Pillers, Globes, according to their Craſſitude.

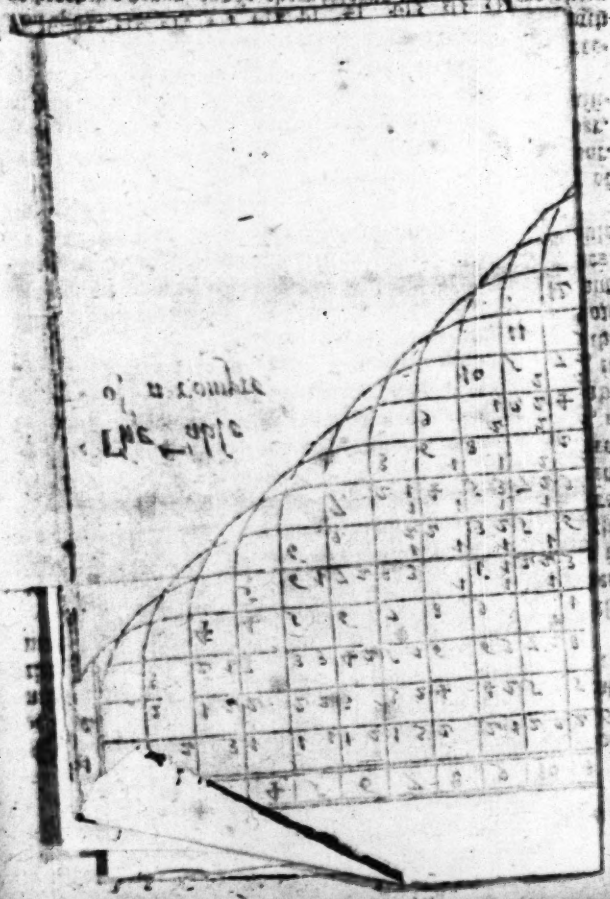
Such as are altogether ignorant of Arithmetik, may reckon by our Engliſh coyne, allowing for every Pearch in length or breadth a penny, and ſo every Marke makes an Acre, every Noble halfe an Acre, every foxy pence or halfe Noble, a roode, and every penny a ſquare Pearch. And ſo by memory without tables, may in ſome rude and groſſe manner, caſt up reaſonable eaſt, the true contents of all Cloſes, Meadowes, Parkes, Hils, or Valleyes.



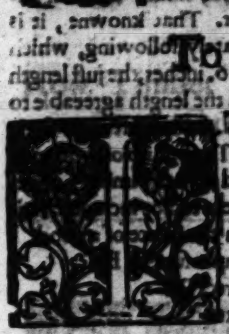
The Table of a compas.

Beware this Table after the booke page 11





To the Reader.



It commeth commonly to paſſe, that Carpenters, Maſons and ſuch like Artificers, are not cither to meaſure Timber, or other things, ſo many times, meaſure or unperfect ſtuffe. Sometimes three, five, ſeaven, or more ſquare in the head, and ſo through: oftentimes round Stone or Timber with hollowed, &c. After I ſhew unto them what miſtake have been ſuch peeces of Timber or Stone, to get their true meaſure, my deſire ſhall here thereof. Craftſmen will leave to be heady or ſelfe willed: yea ſo greedily to ſtick to their corrupted Rules, that utterly they refuſe to be taught.

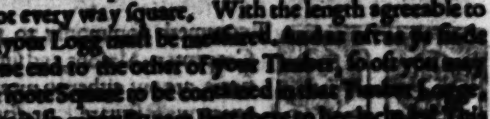
Both learning and experience declareth unto mee, that the grounds which the beſt of them have, are falſe. To open how and where, it needeth not: neither doth it appertaine to inſtruction, onely it may ſuffice him that liketh the true way, here to receive it appointed to him. Yet to ſatisfie and content him, which will not beleeve any ſuch errours or falſe grounds to bee, I ſay (and truly) that the Ruler of Timber meaſure, which the moſt part of them hath, is not made by right Art: Beſides that, their craft in ſeeking the Square of ſome Timber is very falſe. They uſe in meaſuring, to lay the broader and the narrower ſides together in a ſumme, and to take the halfe of that number for the ſquare. Then they ſeeke this untrue ſquare upon the falſe Ruler, and ſo meaſuring the Timber, they conclude of it untruly.

As

To the Reader.

In a foote square is contained 172. Inches.

[illegible] be [illegible] of these Errours, which [illegible] ring may [illegible] you must handle all such [illegible] there shall follow a Table [illegible] declare) the Square of any Stone or Timber. That knowne, it is requisite to have another Table [illegible] following, which may appoint to all true squares from 1. to 6. inches, the just length to make a foote every way square. With the length agreeable to your Square, your Logg must be measured. And so after ye finde it from the one end to the other of your Timber, [illegible] conclude the foote Square to be contained [illegible] or Stone: that so many square feet there is to be [illegible] Table of Timber, [illegible] Rules, well dashed with your measure. By this ye may make or correct Ru[illegible]



Now what I follow it is the true measuring of all sorts of Timber or Stone after round.

[illegible] corrupted Rules that utterly they refuse to be taught.

Book learning and experience declareth unto me, that the [illegible] with the best of them have, are [illegible] and where it needeth not: neither doth it appertaine to [illegible] which will not believe any such errours or false grounds to be, [illegible] (and only) by the Mathematicall number, which the [illegible]

How Timber or Stone foure square every way, or broader on the one side than on the other, may be measured.

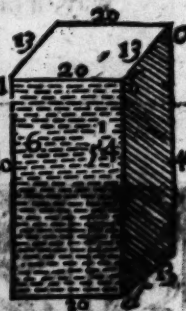
The viii. Chapter.

If a peece of Timber or Stone, be either equally square, broader on the one side then on the other, ye shall take the full measure. Examine, how many Inches the Superficies containeth: then so of the Measure. This done, ye must seek in the table of squares following, the measure of the Superficies five of the Timber or Stone, in the uppermost margine of that table. Then looke for the number of Inches of the equall or narrower side, in the right part and hanging Margine. At the common meeting where the one number answereth directly to the other, there some true square shall appeare. This square so found, shall

[illegible] your Ruler belong to a true square. As often as that measure there found, is contained in the Timber or Stone, so often (and no more) a true square ye may conclude (without doubt) the peece of timber or stone to be.

Ensample.

Suppose this squared Timber or Stone a. b. c. d. were to be measured, the broader side a. b. 20. Inches, the narrower side b. c. 13. Inches, the length 40. Inches. Now I must seeke the broader side 20. in the upper Margine of the table. The narrower side 13. must be found in the right side and hanging Margine. At their common meeting 16. Inches, and ¾. part of an Inch shall appeare. This true square must be searched for in the table of timber measure. Therefore looke for 16. in the Margine of this table. In the Squares with him rightward, ye shall finde 6. Inches, and ¾. which is three quarters of an Inch. Some deale lesse of your Rules then 6. and ¾. laid out upon the timber, maketh a foote Square. Now that measure so directly handled, it containes in the length of your timber five times. Wherefore affirme first of note there to be before that to lese ¼. part of a Foote. Note because the squares of all timber (in this Ensample) use not to rise in inches, but sometime to more parts: therefore accepting to your discretion, note or take away some part more or lesse in seeing forth the Foote square, as above is performed.



Seeing therefore true knowledge, and knowledge in the true quantities of timber, is necessary to all sorts of Squarers. The diuerse handling of them, the which shall follow in sundrie practises.

Of Timber or Stone, 3. 5. 10. 20: or moe ſides ſquare, &c.

The viij. Chapter.

When timber hath vnlyke equall ſquares in the head, and ſo throughe: firſt meaſure all the ſquare ſides rounde about the head or end of the timber. Then take halfe the number of the whole meaſure for one breadth.

Then meaſure from the Center (which is the middle of the head or end of the Timber) to the middeſt of the Square ſide, betweene the two Angles, and take the meaſure of that diſtance for the other breadth. Then reſort with the meaſures of theſe two breadths, (as before) to the Table of Squares: ſeeing the bigger number of breadth in the vpper Margine, and the other letter in the ſide Margine: with the ſquare there found, haue recourſe to the Table of Timber meaſure, and doe as I haue inſtructed.

Enſample.

Admit this ſmall peece of timber ſixe ſquare, c. f. g. h. ſhould be meaſured, euery ſide being 12. Inches. If ye adde together in one ſumme all the ſixe ſides, they make 60. Inches. The halfe is 30. that ſerueth for one breadth. Then the line c. f. which goeth from the Center or middeſt of the Square, to the middle of one ſide, is 8. Inches. The two numbers 8. and 5. muſt be ſought (as before) in the table of ſquares following. At the common meeting, your ſquare ſhall aperteine 15. Inches, ½. This ſquare 15. ſeeke in the Table of Timber meaſure. There ſee may ſée right with it 7. Inches, and ½. Now becauſe of ½. the odde quantitie of the

Square above 15. Inches, lap ſomething leſſe. Then ſee how oftentimes that meaſure (ſo paſſed reaſonable handes) is from the one end of your Timber to the other: and affirme ſo many times a foote ſquare there is in, as that meaſure is found in the length of your logge.

How round and hollow Timber, Steeples, Pillers, Globes, &c. are to be meaſured.

Fourth Chapter.

Firſt girde the Logge round about with ſome Line: then diuide the Line (which commonly that timber in two equall parts: girde the one end for the biggeſt breadth. Which, ye ſhall finde greater then the other end (for commonly euery tree is ſomewhat ſmaller towardes the toppe) in three partes, and take the halfe of one of them, for the other narrower breadth. Multiply the meaſures of theſe two breadthes, halfe to your ſelfe, performing all things as ye haue learned.

Enſample.

Suppoſe this little peece of Timber, i.k.l.m. were to be meaſured, the compaſſe of girding 36. Inches, and the whole length is 18. being the one breadth: then the third of 36. is 12. the halfe of it is 6. which is the other narrower breadth. Which two numbers 6. and 18. enter the Table of Squares following, and in the table of timber meaſure. At the laſt (all things performed as before) you ſhall finde in this table 2. foote, the length l.m. being 18. Inches, 1. foote, and ½. part of a Foote. Which is ſufficient for all ſuch like.

A note of hollowed Timber.

If it chance that hollowed Timber be to be measured: measure the whole Legge as though it were not hollow, as aboue is declared. Then measure the narrownes and breadth of the hollow, and see what is contained in that, as though it were massie timber. Note well and cast the content of it from the whole aboue measured; the remaine of that must needs be the timber is inclosed in that hollowed barke.

I Am unable in few wordes to expresse to the unlearned, by what meane Pyramidall or picked regular Steeples of all fashions are measured. Also how Pillers, Pots the Content of Globes or Bowles are searched, vnlesse the Art of measuring were taken. Wherefore (as aboue is declared) I cease.

How the crassitude of picked Steeples is knowne.

MVltiply the plaine of the Base in the third part of the height: so prouse the Crassitude. Or multiply the Content superficiall (found as I haue taught) in the height of the Steeple, taking the one perpole the third part of the other.

How the Content of Pillers

Either multiply the Base plaine of the Pillers, as is aboue taught, by the long solide.

How the Cubicall bodies of Globes are searched.

THe contene superficiall found, (as I have opened) must be multiplied in the fifth part of the Diameter: the product is that ye require: Or the third part of the superficiall Content is like the Diameter. Or multiply the plaine of the Circle in the whole Diameter: then take two third parts, which added, make the Crassitude.

Of the halfe Circle.

HIs Superficiall Content multiplied (as I said) bringeth the magnitude of him. If any man require ensamples of these last matters, or more sufficient handling: let them resort unto my bookes published of Geometrie, where they shall be satisfied. These little appertaine to Carpenters or Masons: therefore not by ensample declared.

A generall note.

WHen thou shalt bee put to measure some body, hauing eue other of fashion, lacking part of his Square, or having more than his forme: if it lack, then shalt make it perfect, by obseruing diligently the running together of the sides. The parts wanting shall be measured, as though they were there, which portions must be taken from the whole Body measured.

And when there remaineth any more than the forme of Regular Square: first measure the square Body: then the Crassitude which abounded. All put together, doe form the whole irregular Body. Lyke likewise.

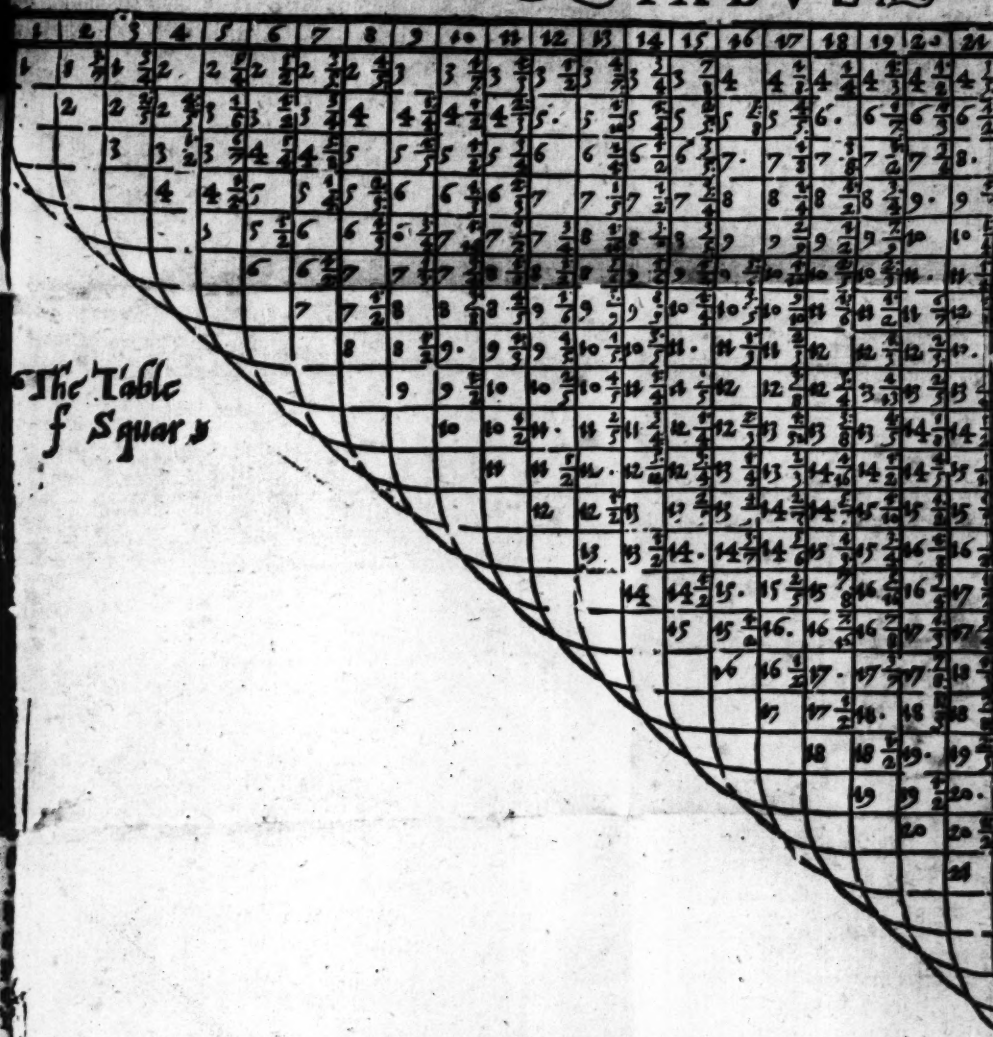
A Table to finde the iuſt Radix or ſquare of any Timber or Stone.

IT behoueth you to know, that this table following is made for the true ſquare of any manner Timber: therefore vnderſtand that the numbers from 1. to 40. ſet aboue in the high Pargine, betoken the Inches of the broader ſide of the timber. And the numbers from 1. and ſo downward to 30. put in the right part and hanging Pargine of this table, ſignifie the Inches of the narrower ſide: and to conclude briefly, the element of figures ſet in euery ſquare roome, betoken the iuſt ſquare. The bigger figures leftward in euery ſquare place, ſignifie the whole Inches. And the other leſſer rightward in the ſame ſquare deuided by a line, the parts of Inches, ½. ¼. &c.

This firſt Fraction toward the left hand, betokeneth one halfe part of an Inch: the other two fifts of an Inch, and euery figure of fraction hauing a point adioyned vnto him, ſome deale leſſe than that part is: as that part ½. repreſenteth ſcant halfe an Inch, a very little quantitie leſſe. And if it had two pricks by him, he ſhould haue declared ſome quantitie more: as this other fraction of part, ⅔. which is more than two fifts, a ſmall deale.

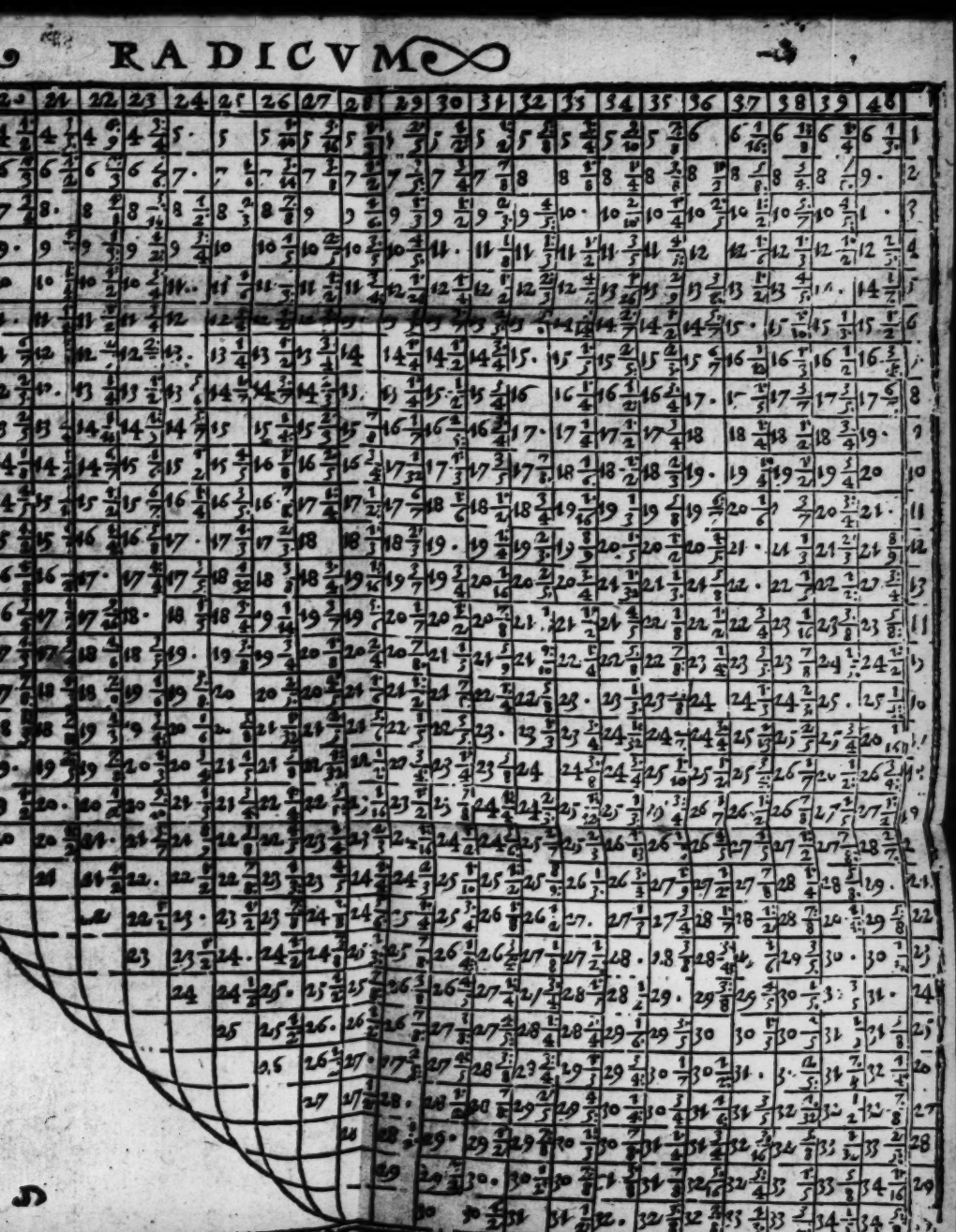
It had not beene needfull to haue put the parts of the Square ſo precisely as they are hereneither is it requiſite ſo curiouſly to take them.

TABVLA



The Table of Square

place this Table between B and C.



A Table to finde the full Radix or square of any Timber or Stone.

The Table of Square

It had not been needfull to have put the parts of the figure so precisely as they are there, either is it requisite to Diuision as truly to take them.

with the declaration and use of it.

The x. Chapter.

THis Table (as ye see) is divided into two Columnes or Rowes: the one verye short, the other longer. In the head of the first, I have put this wayd Foote: in the second row, Inches, and parts, to signifie feet, Inches, and parts of Inches. The summes in the margine and left part of the first and second Columne, declare the quantitie of the square of Timber or Stone from 1. to 36. Inches square. Within the rowes you may finde the just length to a foote square, if yee enter into them in right order accoyding to the square.

Foote	Inches	Parts
1	144	
2	36	
3	16	
4	9	
5	5	9
6	4	
7	2	11
8	2	3
9	0	24
10	1	17
11	1	14
12	1	12
13	1	10
14	1	8
15	0	7
16	0	6
17	0	6
18	0	5
19	0	4
20	0	4
21	0	3
22	0	3
23	0	3
24	0	3
25	0	2
26	0	2
27	0	2
28	0	2
29	0	2
30	0	1
31	0	1
32	0	1
33	0	1
34	0	1
35	0	1
36	0	1

Ensample.

SUppose the square of your Timber were 7. Inches, and that ye desire to know what measure or length of the Ruler would make a Foot square: seek in the left Margine, seven Inches: and with him in that order toward the right hand, ye shall finde 2. Foot, 11. Inches, and $\frac{3}{4}$. of an Inch. Note because the fraction $\frac{3}{4}$. hath a prick by him, it betaketh some small quantitie lesse then $\frac{3}{4}$. of an Inch. If it had two pricks or points thus $\frac{3}{4}$. it should signifie some little quantitie more. Neither maketh it matter whether yee obserue this pricking or no, the quantitie is so little to be added or pulled away.

Note what hath been spoken of Timber, the same also is to bee understood of Stone, likewise to be measured.

Thus is finished the measuring of Timber.

Now ensueth of boord.

How Tables, Boords Glaſſe, or any ſuch like, are meaſured, according to their length and breadth, onely to the foote ſquare.

The xi. Chapter.

THis thing is performed by the helpe of a large Table following, diuided in ſix ſmall Tables, and in many Margines. The firſt and left Margine beginneth at ½. which is one quarter of an Inch, and extendeth to ſix Inches, as ye may plainly perceiue if ye ranne ouer by that Margine. This hath his Table on the right ſide adioyning unto him. The other taketh his beginning at ſixe Inches, ½. and endeth at twelue, having his proper Table alſo. The third from 12. ½. to 18. And ſo from 18. ½. to 24. from 24. ½. to 30. The laſt Margine is from 30. ½. to 39. and there endeth.

Of this that is ſaide, you may gather that euery Margin hath his Table on his right ſide. Alſo you muſt know that in the top, and beneath, I haue put (as in the Table of Timber meaſure) theſe words, Foote, Inch and parts, to ſignifie Feete, Inches, and parts of an Inch. Therefore when ye ſhall meaſure Boord, Glaſſe, or any other ſuch, with the breadth of it, enter this table, and ſeeke that breadth in his proper Margin; there ye ſhall finde in right order how many Feete, Inches, or parts of an Inch, belong to a Foote ſquare. So often as the meaſure is in your ſkuffe, tell as many Feete haue ye in that Boord or ſuch like. If the breadth exceede this table, then diuide the breadth in parts, and worke as is and ſhall be declared. So the ingenious applieth this table for all manner breadths, moſt aptly.

Example.

Fo Yu		Fo Yu		Yu Par		Yu Par		Yu Par		Yu Par	
48		0	1/4	11	3/4	18	1/4	7	7/8	24	1/4
24		6	1/2	11	1/2	18	1/2	7	4/5	24	1/2
16		6	3/4	11	2/3	18	3/4	7	2/3	24	3/4
12		7	1	12	1/16	19	1	7	1/2	25	1
9	7	7	1/4	12	1/8	19	1/4	7	1/2	25	1/4
8		7	1/2	12	1/4	19	1/2	7	7/8	25	1/2
6	10	7	3/4	12	3/8	19	3/4	7	2/3	25	3/4
6		8	1	12	1/2	20	1	7	1/2	26	1
5	4	8	1/4	12	5/8	20	1/4	7	1/8	26	1/4
4	9	8	1/2	12	3/4	20	1/2	7	1/22	26	1/2
4	4	8	3/4	12	7/8	20	3/4	6	15/16	26	3/4
4		9	1	13	1/8	21	1	6	1/2	27	1
3	8	9	1/4	13	1/4	21	1/4	6	4/5	27	1/4
3	5	9	1/2	13	3/8	21	1/2	6	5/7	27	1/2
3	2	9	3/4	13	1/2	21	3/4	6	5/8	27	3/4
3		10	1	13	5/8	22	1	6	1/2	28	1
2	9	10	1/4	13	3/4	22	1/4	6	1/2	28	1/4
2	8	10	1/2	13	7/8	22	1/2	6	3/8	28	1/2
2	6	10	3/4	14	1/8	22	3/4	6	1/3	28	3/4
2		11	1	14	1/4	23	1	6	1/4	29	1
2	4	11	1/4	14	3/8	23	1/4	6	1/3	29	1/4
2	3	11	1/2	14	1/2	23	1/2	6	1/3	29	1/2
2	2	11	3/4	14	5/8	23	3/4	6	1/12	29	3/4
2		12	1	15	1	24	1	6		30	

Fo Yu	Fo Yu	Yu Par	Yu Par	Yu Par	Yu Par
5	30	1/4	4	3/4	
7/8	30	1/2	4	5/7	
4/5	30	3/4	4	2/3	
2/3	31		4	5/8	
1/2	31	1/4	4	5/8	
1/3	31	1/2	4	4/7	
1/4	31	3/4	4	1/2	
1/5	32		4	1/2	
1/6	32	1/4	4	1/2	
1/7	32	1/2	4	3/7	
1/8	32	3/4	4	3/8	
1/9	33		4	1/3	
1/10	33	1/4	4	1/3	
1/11	33	1/2	4	2/7	
1/12	33	3/4	4	1/4	
1/13	34		4	1/4	
1/14	34	1/4	4	3/16	
1/15	34	1/2	4	1/6	
1/16	34	3/4	4	1/8	
1/17	35		4	1/8	
1/18	35	1/4	4	1/32	
1/19	35	1/2	4	1/16	
1/20	35	3/4	4	1/32	
	36		4		

Fo Yu	Fo Yu	Yu Par	Yu Par	Yu Par	Yu Par

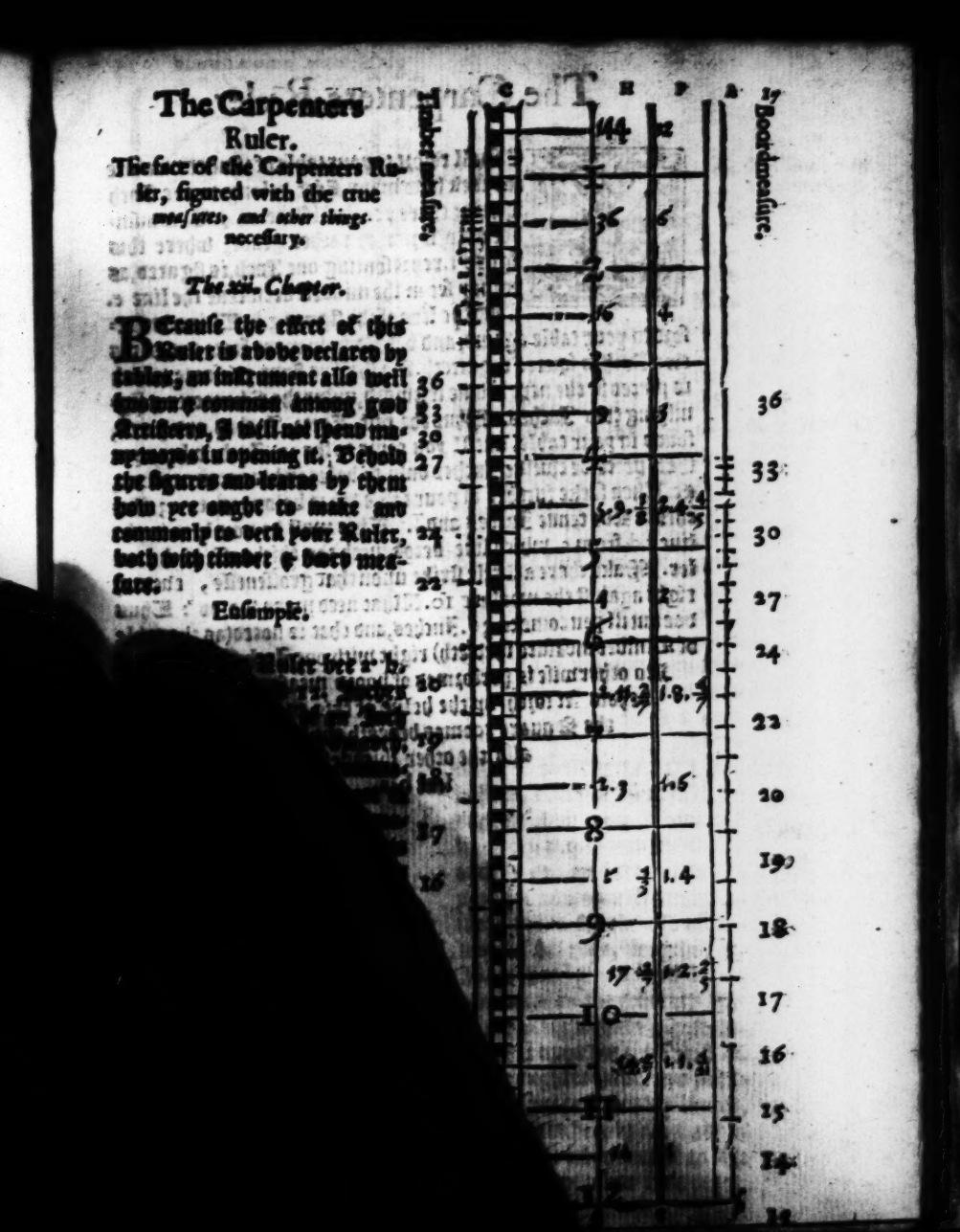
The Carpenters Ruler.

The face of the Carpenters Ruler, figured with the true *measures, and other things necessary.*

The xxii. Chapter.

BEcause the effect of this Ruler is abode declared by tables, an instrument alle well known & common among you Artificers, I will not spend many wordes in opening it. Behold the figures and lenthe by them here set ought to make and commonly to werk your Ruler, both with timber & bord measure.

Ensample.



Ensample.

Suppose I have a pane of Glasse, or a Board, whose breadth were 2 2. Inches $\frac{1}{2}$. the length 16. foote. In the fourth margine, I finde this breadth, 22. and $\frac{1}{2}$. And even with it in the table rightward, I see 6. inches, $\frac{1}{2}$. So much of my Ruler wanting some small quantity, maketh a foote.

Now because in the length of my board (which is 16. foote) that measure is found 29. times, and $\frac{1}{3}$. parts: I conclude 29. foote there to be, and two third parts of a foote Square, according to the length and breadth I salde (wanting some small quantity) because of the point joyned to this Fraction $\frac{1}{3}$. which is put to diminish the fraction some little thing, as is declared plainly in the other Tables before put forth.

HE that desireth to measure Chamber floores, pavements, or such like, let him onely multiply the breadth with the length, so the product sheweth the Content.

Example.

IF there were a pavement 100. foote long, and in breadth 50. I must needs conclude by multiplication of the length in the breadth there to be contained 5000. Foote.

Or thus without Arithmetike; when the breadth exceedeth the Table.

DIvide the breadth in parts (as is showed in the Declaration of the table of account) and worke, as I have before instructed. So for pavements all manner of wayes it serveth your turne. Of this matter to put forth tables, were superfluous tediousnesse and folly. The ingenious with these few will be satisfied.

The

The Carpenters Ruler.

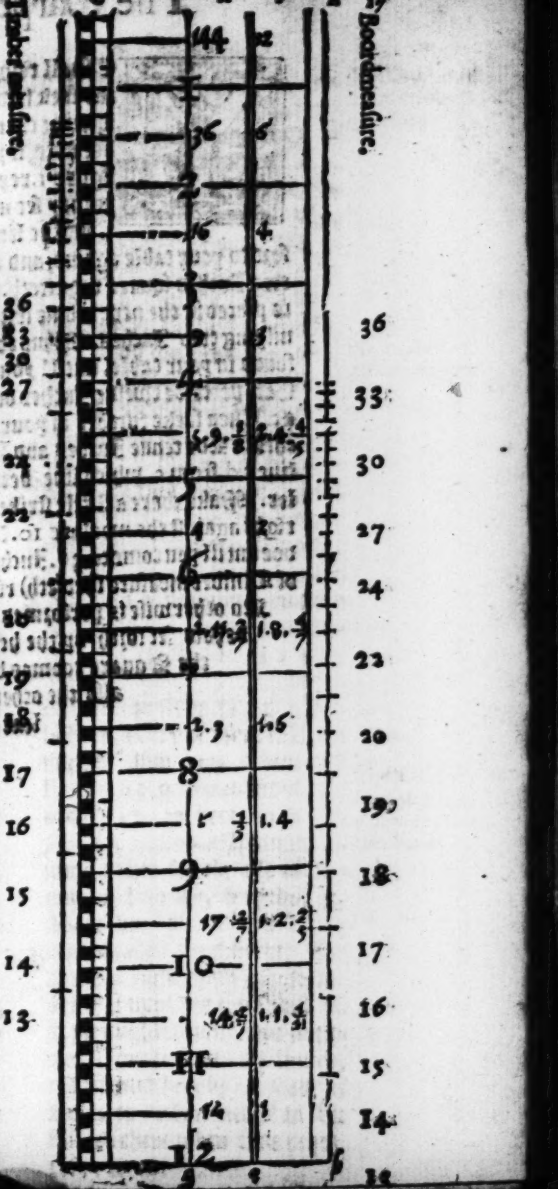
The face of the Carpenters Ruler, figured with the true *measures, and other things* necessary.

The xii. Chapter.

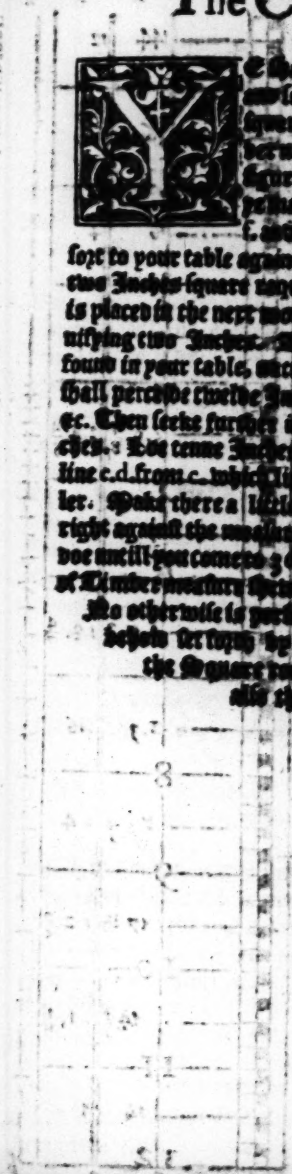
BEcause the effect of this Ruler is abode declared by tables, an instrument also well known & common among you Artificers, I will not spend many words in opening it. Behold the figures and learne by them how ye ought to make and commonly to deck your Ruler, both with timber & bord measure.

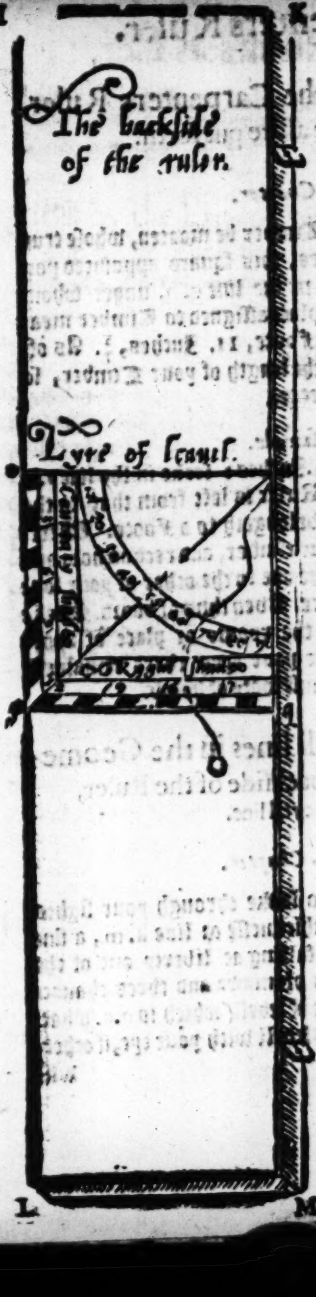
Ensample.

Admit the Ruler bee a. b. c. d. well planed 12. Inches long, a quarter of an Inch thick, & two Inches in breadth. Truly it were more commodious, if it had two Foote in length. This Ruler here imagined, but a Foote in length is divided first in 12. even parts called Inches: then every Inch in halfe or two equall portions: each halfe in two quarters: every quarter in foure or 2. parts at the least: as in this ensample. Then are the figures placed from 1. to 12. manifesting the Inches. Thus your ruler is ready to receive the measures which are marked or figured on your Ruler thus. Abode first the timber measure, as followeth.



YE shall resort to your table of timber measure and seek how many Feet belong to one Inch square: there ye shall finde 144. This number note, write, or rather grave, where this figure 1. representing one Inch, is figured, as ye may see in the mid⁹ betweene the line e. f. and the line of the figure g. h. This done, resort to your table againe, and behold how many foote any peece two Inches square requireth. So shall ye finde 36. foote, which is placed in the next meane leftward, under the Character 2. signifying two Inches. Thus the rest. Foote, Inches, and parts, found in your table, untill you come to the 12. Inch, where ye shall perceyue twelue Inches only to be set in his proper roome, &c. Then seeke further in your table what belongeth to 13. Inches. Lo tenne Inches and $\frac{7}{2}$. This must be numbered in the line c. d. from c. whych line betokeneth the thicknesse of the ruler. Make there a little strike upon that grossenesse, euen ouer right against the numbre 10. What need many wayes? Thus doe untill you come to 36. Inches, and that is noted (as the table of Timbers measure sheweth) right with one Inch and $\frac{1}{2}$. from c. Also otherwise is purchased all maner measure, as ye may behold set forth by the helpe of this proper table in the Square rowmes beneath the line e. f. and also the other thicknesse of line b. a.





The xiii. Chapter.

This other figure i.k.l. m. is the backside of your ruler, having in the middst of Geometricall Quadrant n.o. p.q. whose making in few words is thus expressed. The line of breadth of your Ruler n.o. the line o.p. p.q. q.r. ought to be of one equall iust length, cutting each other equirewise. And from the center n. unto p. is drawne another line, which is called the Line of height. So is o.n. the line of levell, q.r. the line of heights upright: this knowne, I open my compasse, one foot remaining in the center r. the other extended in the line of levell almost to o. making a circumferrence to q.r. which is a portion of a circle named a quadrant and ought to bee divided into 90. equall parts, as ye may behold, every of them called a degree. Ye may divide the lines o.p.p.q. named the Scale each in 12. as here, or in 60. ye in a 100. equall portions as more meete for the use of shadowes, heights, lengthes, &c. Note that p.o. or half Scale R.o.p. is called the contrary shadow p.p. right shadow, remember that upon the thicknesse m. k. ye ought to have two fine equall square sights well boxed, represented here by r.s. made of wood, or rather metall to bee fastned there when time requireth: let this satisfie.

The making of a Geometricall quadrans.

Note these 3. principall lines.

The divided sides o. p. and p.q. are called the Scale.

The common uſe of the Carpenters Ruler, touching the face afore put forth.

The xiiii. Chapter.

The eighth Chapter ſheweth how the true Square is found.

Suppoſe a peece of Timber be meaten, whoſe true ſquare is 7. Inches, this ſquare appointed pon to the figure of 7. in the line g. h. under whom right ward in the place aſſigned to Timber meaſure is written 2. Foote, 11. Inches, ½. As often as that meaſure is found in the length of your Timber, ſo many foote of timber is in that peece.

Another Enſample.

IMagine your ſquare to be 22. Inches: ſeeke in the line g. c. how then how much of your Ruler is left from that to the end of your Rule c. and ſo much belongeth to a Foote. Therefore lay out the meaſure upon your timber, and reckon how many times ye may finde it, from the one to the other of your logs: for ſo many foote of timber is there. Even thus of boords. Sheeke the breadth upon your Ruler, in the roome of place of boords meaſure, and immediately before your eyes there remaineth what is to be laid out to make a iuſt foote of boords.

The uſe of the principall lines in the Geometricall Quadrant on the backſide of the Ruler, and firſt of the Levell line.

The xv. Chapter.

IT behoveth you to looke through your ſights q. r. placed in the thickneſſe of line k. m, a fine thred and plummet falling at liberty out of the Center n. If this plummet and thred chaunce preciſely on the line of levell (which is n. o. whatſoever ye ſee through the ſights, is levell with your eye, if otherwiſe

with the thing that ye looke vnto is not levell, either more or lesse then the height, as levell as your eye: More, if the plummet fall to you ward: lesse, if contrary.

How by the Line of Levell to foresee whether the water of any Spring or head is possible to be brought to a place appointed, and also to iudge the wholesomnesse of it.

The xvi. Chapter.

WE shall goe to the head of Spring, and set your Ruler to your eye (being in height equall with the water) so that the fine eye and Plummet fall precisely in the line of Levell. Now if through the sights ye may see above the place, know and iudge the water possible to be brought: if your sight fall under, impossible. It commeth commonly to passe, when the place to which ye would have water conveyed, is of any great distance from the head, then Hills, Valleyes, and such like impediments, let the line of sight to have his true course: wherefore this remedy is provided. At the head of the Spring, yee shall looke thorow the sights (as before) and note a marke in the next Hill toward the place, then goe to the marke, in like manner observe another in some Hill: so forth until by any of them yee may perceive the place desired. If then your sight running through the pinnes of your Ruler (the thred ever falling on the Line. n.o.) excede that place, the conveying of your water is possible. Otherwise not.

Now by the way briefly ye shall be instructed, how ye may know the wholsomnesse.

How good water is knowne.

TAke a cleane Pot, and put water in it, so set it on the fire: after a little boyling, powre it out, if then no filth re-

maine in the bottome of the pot, it may be iudged the wholesommer. Or thus. Let fall drops vpon mettall, or rather on Glasse (any of them being polished) and suffer that to lye by it selfe: if after there remaine no spot or signe, it is a good token. Moreover, if your water be sweete, pure cleare, light, or of little weight, it followeth the water to be wholesome for the vse of man.

Of the Line of Height.

WHensoeuer the Rhed and Plummet doe chaunce iustly on the Height, which is n. p. the Altitude or Height that ye see is euen with the distance from the middle of your Foote, to the nether part directly vnder the toppe, equall with your standing, euying the Height at your Eye aforemaid. Marke that ye must euer stand vpright with Body and Necke, your Feete iust together, the one Eye closed, &c.

The line of vpright Altitudes.

I Vnder also any thing plumbe vpright when the sidenesse of your Ruler i. l. is rieleiy thereon, the Plummet then at Liberty falling on q. n. named the Line of heights vpwards. Now followeth the vse of the Scale.

To search out Heights by the Scale with the aide of two places.

The xviii. Chapter.

SEt the Rhed and Plummet fall in the one, on the 12. points: in the other Section, on the 6. of the right shadow: double the distance betweene the two places, the summitie appeareth from that part of the thing measured, which is equall in height with your

eye,

eye. Or the one in the 12. the other in 3. of right shadow: then triple the distance. The one in 12. the other in 6. of right Quadruplate, the space. The one in 12. the other in 6. of the contrarie shadow, then the space betweene both the Stations is equall with that ye measure, ever understanding from your eye upward. Even that same commeth to passe, if in the one the Thred be found upon the 6. of the contrary, in the other on the 4. of the same, or the 4. and 3. of the contrary. In all these the spaces are equall with the altitudes. So then in measuring the distance betweene the two places, ye have the height from your eye upward, putting to it the length from your sight downeward, the whole Altitude appeareth: the Base being equall with your standing.

How lengths in heights are knowne.

I would not have you ignorant here how to know lengths which be in the height not easie to come unto. For (as before) I get the height of the toppe, the Altitude of the Base or longest part of your length. Subduct the lesse height out of the more, of force your desired length remaineth. Or thus: Let the plummet and thred fall in the 12. part of your place: goe in towards the thing (the thred as it was) untill yee see the Base of that length: the distance betweene the two standings, is undoubtedly the length.

How with Scale direct or upright heights by their shadowes are declared.

The six. Chapter.

Frame your left side unto the Sunne, suffering his Beames to pearce both your sights q. r. placed (as afore is said) in the thickenesse of line k. m. The Thred of plummet then hanging at liberty, out of the centers. sheweth as well the degrees of

of height to be counted from o. as the parts of the Scale cut. If your third ber found in the 12. part of line of level, shadowes of all things being perpendicular elevated, are equall with their bodies. If the plummet with the third be perceived, cutting the parts next to the sights, which I name points of the right shadow, then every thing direct is more then his shadow, by that proportion which 12. exceedeth the parts, where the third was found. If it fall in 1. that is the first part of the right shadow, take the shadow twelve times, to make the height in two, that is the second part, sixe times, in the third foure times: in the fourth, three times: in the fift, twice: and $\frac{1}{2}$. of the shadow, in the sixt, twice; in the seventh once, and $\frac{1}{2}$. in the eight once, and $\frac{1}{3}$. in the ninth once, and $\frac{1}{4}$: in the tenth once, and $\frac{1}{5}$. in the eleventh ye shall take the shadow once, and $\frac{1}{7}$. part of it.

Right shadow. If the art of numbring were had, I would will you to multiply the length of the shadow by 12. and the product divide by the parts, in the which ye found the third.

Contrary shadow. But if it be in the parts of the contrary shadow, augment the length of the shadow with the parts declared by the plummet: and in the increase divide them by 12. so commeth the Altitude also.

Thus the composition and whole appliance of the Carpenters Ruler is shewed: therefore somewhat shall be now said of the Squire.

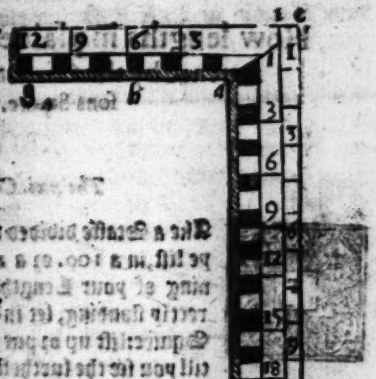
I am not ignorant that the common use of him, is better knowne than I can with many words expresse, wherefore I leave to write in that behalfe. Notwithstanding I will declare how Heights and Lengths are taken, &c. matters rare and knowne of few Artificers.

Also by tables to get a true knowledge of the day, houre, and that diverse wayes, with the helpe of the Squire, as is opened in my generall Prognostication, augmented in the yeare of our LORD 1556.

What

What length the sides of the Squire ought to be, and the division of him.

The xx. Chapter.



I Meane not to put forth the exact making of this Instrument (as well knowne. To thereto the figure. One side (suppose) two foote from the inward Angle: and the other a iust foote from the same. The longer a.b. inwardly diuided from the Angle a. vnto b. into 24. equall principall parts, and euery of them into 4 lesse (if ye list) each containing 10. minutes, also the side c.d. in the outward contrarie plaine from the toppe c. vnto d. is diuided into 12. euen portions: and againe (if ye require exactnesse) euery of them into 6. each of value 10. minutes: Behold a line and plummet falling from c. to f. a Paralell to c.d. and a.b. Thus this squire is well framed for the use of diuers Tables put forth in my generall Prognostication, and also for the finding of Altitudes & Longitudes, which here I purpose now briefly to open.

How by the Squire heights are knowne.

AAltitudes of heights are found, the line and plummet centered in the first point, cutting the moueable.

moderate sights placed in a. g. and a. parallel from that line vnto vnlike, as is opened of the line of height, in the back of my Ruler.

How lengths in plaine Ground are searched by the Carpenters or Masons Squire.

The xxi. Chapter.

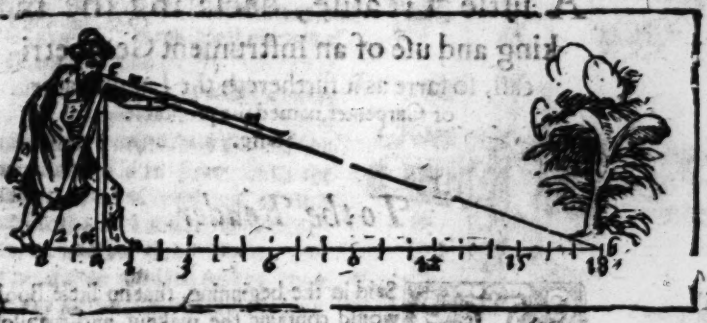
Take a Staffe diuided into certaine portions as pe list, in a 100. or a 1000. parts. At the beginning of your Length, vpon the vtter coppe directly standing, set in the inward Angle of the Squire: lift vp or put vnder the instrument vntill you see the furthest part of your length, by meane vntill your sight running from that Angle, to the end of your Squire, come vnto the furthest part of your length. The Squire so remaining, and the Staffe not remouing from his height. Marke where the other end of the Squire reste vnto vpon noted vpon the ground. Note what proportion the Staffe then beareth to the part of the ground, which the nearest end of the Squire pointed vnto from the Staffe: the same shall the Length haue to the quantitie of the same Staffe.

Ensample.

The cause is taken out of Euclid. 33. pro. 1. Booke and the 4. pro. 6. Booke.

The Staffe a. c. in this figure is imagined 6. Foote; now the space a. d. 2. Foote. Considering now that 6. the length of the Staffe containeth 3. thrice, therefore the Longitude desired, a. b. of force must containe three times the Staffe (which Staffe is 6. Foote) that maketh 18. Foote. As this is proued vnto be a small ground in the figure following: so the Eye likely vse in a greater space, which the ground Speculator

Speculation and diligent Practise by any long exercise learnt. But experience vulgarly saith this to confirm, that the Squire is not conducible for any long distance, but the Instrument Geometricall (whose making and use ye may perceive in the treatise following) unlesse ye affixe some kind of sight for your eye, which length whereof, shall stand in stead of your Staffe.



A Note.

BE beseecheth you to have a fine eye, made fast in the upper part of your Staffe, c. which shall be open when the intrare edge of the Squire, and is to stand to the ground, where the neere end of the Squire from the Staffe pointed, as ye see. d.c. the other end then truely directing to the farthest distance.

Know that the ground must be very plaine and levell, otherwise error ensueth.

Thus the use of the Squire is here somewhat declared, but more in my generall Hypomnematicon, you most plentifully hereafter (God sparing life) in a Booke titled, The vses also of the Squire in practises Mathematicall. In the which Booke, most-table pleasure experiences shall be plainely opened (onely of me practised) as well of Perspective, as of the Mathematicals in generall.

A little Treatiſe, declaring the making and uſe of an Inſtrument Geometricall, ſo farre as it furthereth the Landmeater or Carpenter, named the profitable Staffe.

To the Reader.

I Said in the beginning, that no little Booke would containe the making and manifold fruites of this princely inſtrument, if it were ſet forth as it ought to be in his perfection. Certes the trueth even here maketh me confeſſe the ſame: yea that there is no Inſtrument ſo generall and profitably pleaſant: Notwithſtanding know (Gentle READER) that the occaſion of his chiefe uſe and profit is not here miniſtred: neither, to ſay the truth, doth it appertaine to, or agree with the capacity of ſuch Artificers. Therefore I ſhall leave to increate of his ample large uſe and beſt making, and will ſet him forth in few words; yea ſufficiently for the Land-meeters capacitie or Carpenters purpoſe, that at the leaſt, they may receive ſome kinde of fruite with the Geometer. And in time to come (by other meanes) as I ſee cauſe, I will largely declare, and there deck him with his proper beauties. Here now followeth the making, and ſo briefly, how he is applyed for the profit of the aforenamed Artificers.

The

The making of this profitable Rodde or Staffe.

WE ſhall prepare two ſmall ſtreight, ſtiffe, rules, or rather ſquare rowles of metall or of wood, well plained of like bignes and length. Although it make no matter of what length, yet to auoide the errours, which little Inſtruments, and ſhort ſlades bring, and alſo to beare with the rude vnexpert handling of ſuch Artificers: let our Rodde be early fiue, or at leaſt three Foote, and euery Foote diuided in 12. euen parts or Inches, as ye ſee a. b. and c. d. Theſe Rules, muſt be fitted with a pine in the end of them to ioyne readily toune or fiue Foote in length, (when time requireth) as the figure e. f. ſheweth. Alſo ye muſt get (by the helpe of ſome Artificer) foure other like Rules, the longer g. 2. Foote: the next h. 1. Foote: the other 1. 6. Inches, then k. 3. Inches, the laſt and ſhorteſt l. 1. Inch and ½. Euery of theſe muſt haue in their middeſt a hole, that the long Rodde often Foote may be put through them, and they moued as him at pleaſure vp and downe, alwayes cutting the longer Staffe of, ſequentially, and make to tarry on any diuiſion.

as occaſion ſhall be given: which all are eaſily to be perceiued by the figure following, although my rude declaration hath not expreſſed my meaning.

Here note in the ſtead of your ſhort ſlaues, ye may haue one croſſe ſtaffe two foote long, with current ſights, ſo artificially made, that alwayes the ſhort ſtaffe ſhall runne ſquire vpon the longer, and the ſights diſtant, as ye liſt to place them.

Things needfull to be knowne before the uſe of this Inſtrument is opened,

The ij. Chapter.

BEfore I intreate of this vſe, it behoueth to know things neceſſary, and firſt which of the fiue little ſlaues g.h.i.k.l. mentioned in the making is to be put on your long ſtaffe e.f. according to the diſtance of the marke. Note if your mark be neare hand, be it length, breadth, or height, the longer g. doth ſeeme meetest to haue the roome, if more of length, the other h. and ſo the further diſtance, the ſhorter the ſtaffe requireth to be, which ſhall occupie that place. Of practiſe herein this better than many words. Alſo note, if chance be to goe farre from your marke, (as after you ſhall ſe how) you muſt remoue the ſhort ſtaffe inward more neere to the end of the longer. If you be compelled to goe from it, then put it from. vnto the end. Alſo remember when you are appointed to meaſure any breadth or length (as ſhall be declared) it behoueth you to ſtand right with, and againſt that breadth: yea, and the longer the breadth or larger the wideneſſe or length is, the better the thing will come to paſſe. And for heighes it is neceſſary (if you regard preciſeneſſe) to haue the height ſtand directly vp.

Note this that followeth to be generall in all Workings.

YE muſt ſtand right vp with your Body and Backe, your Feete full together, your hands not much moouing, the eye

eye closed, and ever marke your standing right with the middest of your staffe. We not ignorant here, that I call the rudenesse of the little staues, the very ends where y light ebet runneth. And no difference betweene the Altitude and height, betweene the Longitude and length: the Latitude and breadth. The short staues I vnder the letter n. are ouer them. Your eye muste ebet be placed in the end of the longer staffe c. and with the other eye ye ought to winke.

What these words meane. Longitude, Latitude. Altitude.

These trifles and such like omitted, letteth the truth to come to passe, and make men to suspect the Ground, which is most certaine.

How heights standing directly up, are measured by the Instrument.

The iij. Chapter.

Set the staffe g. upon the longer e. f. and moue him his full length from the beginning of the longer e. turne the ends of g. toward you, and according to that height placing your eye (as is said) ebet at the beginning of the longer e. with the other eye winke. Then get back until yee may plainely perceiue the very vpper part of that Altitude. and still the lower end by the extremes of your shorter staffe g. Now the space of the middle of your feete to the base of the height is equall with the Altitude.

Or thus.

Suppose ye shall see any Altitude, whose measure ye require, imagine by coniecture how oftentimes that height is found in the place from it vnto your standing. Then moue your shorter staffe (choise as aboue most conuenient) euen as often his owne length from the beginning of the longer c.

where your eye is euer placed. This done, turne the ende of your little staffe, your eye being euen according to the height: looke whether yee may see by the extremes of your shorter staffe the very top, and also the lowest part of the height. If not, moove the shorter a length further towards or neere to me, as ye see cause, and as your coniecture failed. Yet let your little staffe remaine, as by coniecture he was put, and goe towards or from that height, vntill the altitude agree iustly with the extremes of your short staffe. Then marke that place with the middest of your foote.

Now ye may conclude, that the height is as often contained in the distance, which is betweene the marke and it, as the length of that little staffe is found remooued from the end of the longer staffe.

Ensample.

How the just height is knowne.

If the short staffe be tenne times his owne length from me, affirme the height contained in that distance ten times also.

The Altitude is thus gotten. Moove your short staffe from his late being a length either toward or from me, as ye list to goe in or back. Then go fro or nere vnto it (as before) vntill the very summitie, and also the lowest part of the height agree with the extremes of your shorter staffe. The space then betweene your marked place and this latter, declareth the iust height. Oft times through impediments, yee shall not haue roome to goe so farre backe or forward, as the height commeth vnto. This remedie is prouided.

A remedy prouided for want of ground.

Moove the little staffe haife his length, and so seeke two stations (as before) vntill the extreme of the shorter staffe bee found iustly to answer either end of the height. Then the space betweene the two standings must be doubled to haue the iust height: or if you list, yee may moove the shorter, accounting to the fourth part of his length, or to any portion, as to the iift, first, tenth, &c. then shall yee haue that part of the height betweene the two stations.

Yet

Yet know this (which experience by diligent practife will ſhew) the biggeſt paces yee take, the leſſe errour ye commit. A little errour often multiplied, encreaſeth to a great.

Now that all the afore ſpoken may the better be perceiued, beholde the example ſtanding, as yée may ſee by figure declared, in the which the height is imagined a.b. the firſt ſtation c. the ſhort ſtaffe g. is meaſured from c. iuſt his length. I am forced to conclude, that the Baſe of the height a.b. is from my ſtanding c. eyght his priſtie length. But then if yée meaſure that diſtance of a.c. being 13. paces, ye haue the true height of a.b. as many. In the other ſtanding place d. the ſhorte ſtaffe is found from c. twice his length and a halfe, wherefore I muſt affirme the height a.b. to be elenatore as is found in the diſtance a.d. twice and a halfe: which length a.d. is apparant 32. paces. All that hee is ſpoken of the height, may well be underſtood of Altitudes or vnderneſſes, and lengths following.

The ground of this may be gathered of Euclide in his perſpective. 21. Theo.

In Altitudes this rule is not perfect, except the eye be leuell with the middle of the Altitude.

How the breadth or wideneſſe of things are found, and by them, Length or any diſtance at pleaſure.

The iiij. Chapter.

Vnderſtand I haue inſtructed ſkaye of heights, the ſame obſeruations here of wideneſſe, length, &c. For none otherwiſe are Latitudes or wideneſſes ſearched by this Inſtrument, then before is declared of heights, onely this excepted, that the ſtaye ſtaffe muſt ſtand contrary, the eyne anſwering to the breadth, ſeeing by the extremities of the ſtaye ſtaffe, the very vttermoſt parts of eyther of the Latitude, noting your ſtations right with the midſt of your Foote; And ſo performe all as before. And as I ſaid, thereof the parts of the height found betweene your ſtandings, eſpecially things to well vſed here, for all manner parts of the breadth.

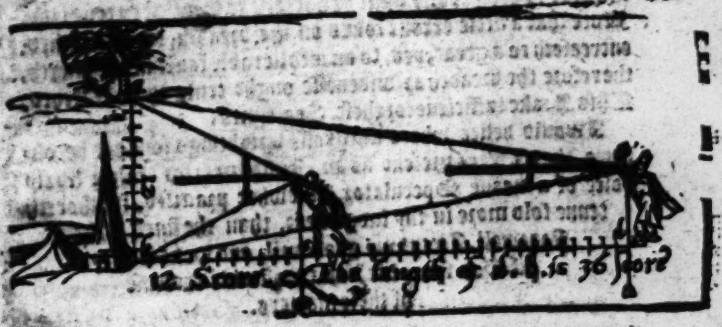
Enſample.

The breadth in this figure following ſuppoſe a.b. Alſo the firſt ſtation c. the next d. Nowe deſire to know the wideneſſe a.b. and the length or diſtance d.b. Marke how the eyne of the leſſer ſtaues are turned to the extreames of the wideneſſe. Then behold how the ſtaye ſtaffe in c. is but eyne his length removed from c. Wherefore (by the inſtructions of height ſo afore) ye may boldly ſay, that the wideneſſe a.b. is but eyne quarter betweene d. and b. and that meaſure is found 12. ſkaye, as much as in the other a.b. In the ſecond ſtanding d. the little ſtaffe is removed three times his length from c. For that cauſe I conclude (and truly) from b. to that ſtation three times the breadth, which breadth is 12. ſkaye. So by the wideneſſe I haue found the length of b.d. 36. ſcoyes, my deſire. Thus are Latitudes found, and by them lengths, &c.

Behold

Behold the figure.

You muſt alwayes ſtand directly againſt the middle of the Branch.



Whenſoeuer any diſtance is put, whoſe certaine length ye require: meaſure (by the art ꝓpoſed) either the height of any thing there found, or the breadth, and ſee how oftentimes that indenelle or length is contained vnto your ſtanding: which knowne, the length cannot be hid, as is declared.

NOw in few words to conclude, ye may by this Inſtrument meaſure the diſtance of Houſes, Steeples, Trees, the length of Walles, and breadth of Ditches, Images in height, and ſuch like. The good wittie Carpenter ſtanding in a place, where he may plainly ſee a whole Houſe, or any manner frame with great pleaſure, may by this get ſpeedily the true ꝓportion of that Houſe, which he ought to note in a Table, and when time commeth (not without his great praiſe) may make, reare and ſet up the like. This I take to be ſufficient for theſe Craftſmen. A more larger uſe of this Inſtrument.

I haue

FINIS.